

(19) JAPANESE PATENT OFFICE (JP)

(12) Resistration of Utility Model Application (U)

(11) Japanese Utility Model Registration Number: 3001011

(45) Issue Date: August 16, 1994

(24) Registration Date: June 8, 1994

(51) Int. Cl. <sup>5</sup>	Identification Symbol	JPO File No.	F1	Technical Indication
G 02 F 1/1333		9225-2K		
1/133	505	9226-2K		
1/1335	530	7408-2K		
G 09 F 9/00	350	A 7244-5G		

Request for Evaluation Form: Not requested      Number of Claims: 5      FD      (11 pages total)

(21) Application Number: H6-1877

(22) Filing Date: February 14, 1994

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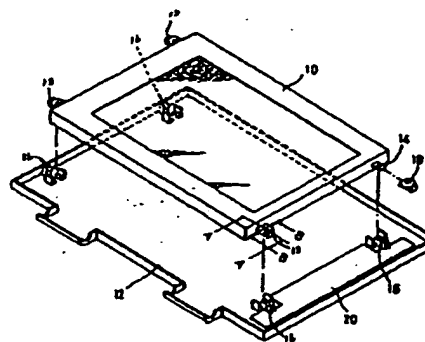
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(54) [Title of the Device] ATTACHMENT STRUCTURE FOR LIQUID CRYSTAL DISPLAY DEVICE

(57) [Abstract]

[Object] [The object of the present device is] to provide an attachment structure for a liquid crystal display device which makes it possible to accomplish the mounting of a liquid crystal display device and digitizer with screw connections being omitted in this mounting, and which can prevent complication of the structure caused by wiring.

[Constitution] [The present device] is characterized by the following: namely, fastening parts 14 are disposed on the outer peripheral parts of the panel of a liquid crystal display device, and hooks 16 are disposed on the inner peripheral parts of a case 12 on which the above-mentioned panel 10 is mounted. Furthermore, holders 18 consisting of plate springs whose end parts at one end cover the upper surfaces of the above-mentioned fastening parts 14, and whose other end parts are engaged with the [above-mentioned] hooks, are inserted between the above-mentioned fastening parts 14 and hooks 16.



**[Claims]**

**[Claim 1]** An attachment structure for a liquid crystal display device which is characterized by the fact that fastening parts are disposed on the outer peripheral parts of the panel of a liquid crystal display device, hooks are disposed on the inner peripheral parts of a case on which the above-mentioned panel is mounted, and holders consisting of plate springs whose end parts at one end cover the upper surfaces of the above-mentioned fastening parts, and whose other end parts are engaged with the [above-mentioned] hooks, are inserted between the above-mentioned fastening parts and hooks.

**[Claim 2]** The attachment structure for a liquid crystal display device according to Claim 1, which is characterized by the fact that the second end parts of the above-mentioned holders are engaged with the above-mentioned hooks, and [these holders] are constructed so that portions of the holders in the direction of width are extended to form terminal parts, and so that these terminal parts are pressed against the ground terminals of the printed board disposed on the above-mentioned case.

**[Claim 3]** The attachment structure for a liquid crystal display device according to Claim 1 or Claim 2, which is characterized by the fact that the first end parts of the above-mentioned holders are substantially L-shaped bent parts.

**[Claim 4]** An attachment structure for a liquid crystal display device which is characterized by the fact that ground pattern parts are exposed around substantially the entire circumference on the outer circumferential part of the base plate of a pressure-sensitive type tablet disposed on the front surface of the panel of a liquid crystal display device, and packing consisting of a conductive rubber is clamped between the above-mentioned ground pattern parts and metal plating parts formed on the inside surface of a case.

**[Claim 5]** An attachment structure for a liquid crystal display device which is characterized by the fact that a transparent light-conducting sheet is clamped between a reflective sheet and the undersurface of the panel of the liquid crystal display device, a light source is disposed on one side part of the above-mentioned light-conducting sheet, plastic fibers are disposed along the undersurface of the above-mentioned light-conducting sheet, and a portion of the incident light from the light source is transmitted directly through the light-conducting sheet, and is directed onto the panel of the liquid crystal display device via the plastic fibers and light-conducting sheet.

**[Brief Description of the Drawings]**

[Figure 1] Figure 1 is a perspective view which shows the overall construction of an attachment structure for a liquid crystal display device illustrating one embodiment of the present device.

[Figure 2] Figure 2 is a sectional view of essential parts along line A-A in Figure 1.

[Figure 3] Figure 3 is a sectional view of essential parts along line B-B in Figure 1.

[Figure 4] Figure 4 is a perspective view of essential parts illustrating another embodiment of the present device.

[Figure 5] Figure 5 is a sectional view of essential parts in Figure 4.

[Figure 6] Figure 6 is a perspective view illustrating another embodiment of the present device.

[Figure 7] Figure 7 is a partially sectional perspective view illustrating another embodiment of the present device.

[Figure 8] Figure 8 is a sectional view of essential parts in Figure 7.

[Figure 9] Figure 9 is a sectional view illustrating another embodiment of the present device.

[Figure 10] Figure 10 is a sectional view of essential parts in a conventional attachment structure for a liquid crystal display device.

[Figure 11] Figure 11 is a sectional view of essential parts illustrating a modification of Figure 11 [sic]\*

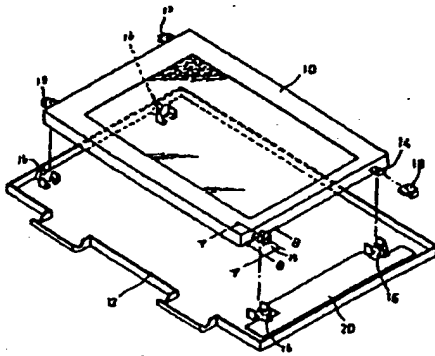
**[Explanation of Symbols]**

- 10: Liquid crystal display device
- 12: Lower case (case)
- 14: Fastening parts
- 16: Hooks
- 18: Holders
- 20: Printed board
- 22: Digitizer
- 24: Pressure sensitive type tablet
- 26: Base plate
- 28: Ground pattern parts

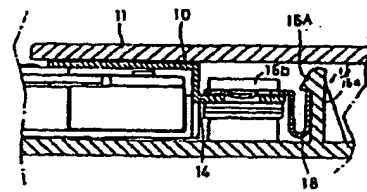
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\* Translator's note: apparent error in the original for "Figure 10."

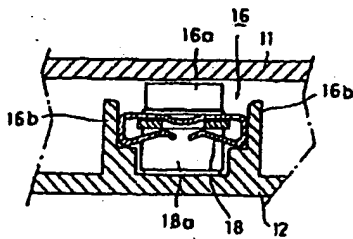
- 30: Metal plating parts
- 32: Packing
- 34: Reflective sheet
- 36: Bent reflective part
- 38: Light-conducting sheet
- 40: Light source
- 42: Plastic fibers



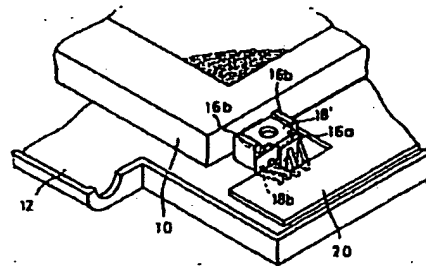
[Figure 1]



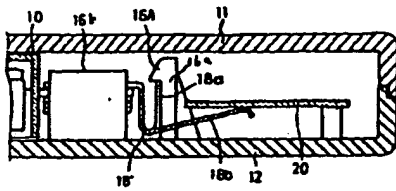
[Figure 2]



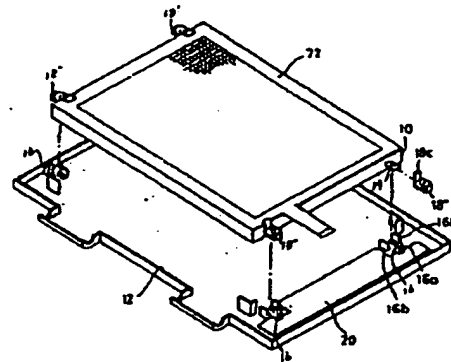
[Figure 3]



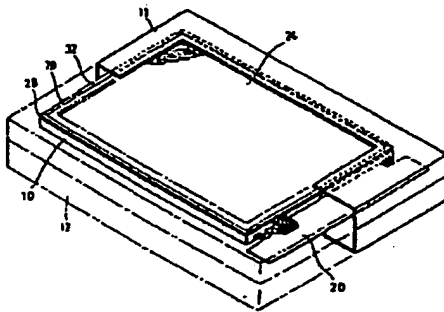
[Figure 4]



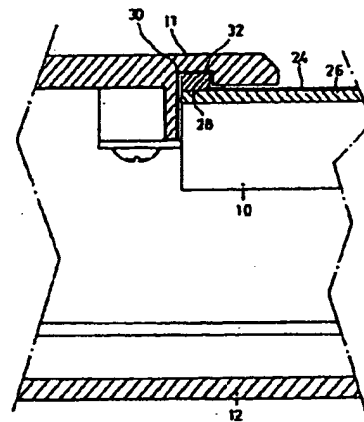
[Figure 5]



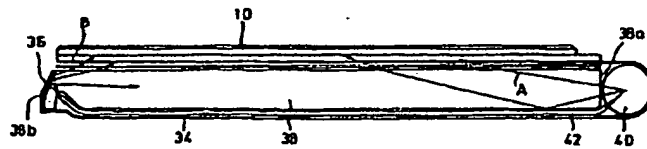
[Figure 6]



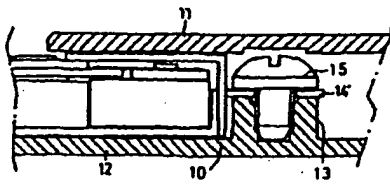
[Figure 7]



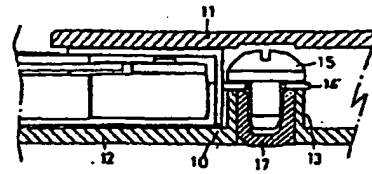
[Figure 8]



[Figure 9]



[Figure 10]



[Figure 11]

**[Detailed Description of the Device]**

**[0001]**

**[Field of Industrial Utilization]**

The present device relates to an attachment structure for a liquid crystal display device.

**[0002]**

**[Prior Art]**

As a conventional attachment structure for a liquid crystal display device, the liquid crystal display device is mounted in a lower case, and attachment parts disposed on the outer peripheral part of the liquid crystal display device are connected to boss parts of the lower case by means of retaining screws.

For example, as is shown in Figure 10, 11 indicates an upper case, and fastening parts 14' which are disposed on the outer circumferential part of the liquid crystal display device 10 are disposed on boss parts 13 on a lower case 12, and are connected by means of retaining screws 15.

Alternatively, in the structure shown in Figure 11, insert nuts 17 are attached to the boss parts 13, and the fastening parts 14' are connected using retaining screws 15 that are screwed into the insert nuts 17.

As is shown in Figures 10 and 11, it has become impossible to ensure the required dimensions for the height of the boss parts 13 and the height of the insert nuts 17 as liquid crystal display devices 10 have become thinner, so that adequate connection by means of screws has become difficult.

**[0003]**

Furthermore, lead wires that are fastened together with lug terminals not shown in the figures are connected to the above-mentioned fastening parts 14' and thus grounded. Moreover, the liquid crystal display device 10 is bonded together with a digitizer using a two-sided adhesive tape, etc. None of these connection and bonding systems can handle an increased thinness of the liquid crystal display device; furthermore, connections using lead wires complicate the construction, and make it impossible to shorten the time required for assembly work. Moreover, maintenance work is made difficult, and since the digitizer is bonded to the liquid crystal display

device, peeling is not easy, and there is a danger that replacement of the digitizer will be made more difficult.

[0004]

Furthermore, a pressure sensitive type tablet is disposed on the front surface of the panel of the liquid crystal display device in a pen input personal computer, and since shielding countermeasures against electromagnetic waves, etc., are not taken in this tablet part, electromagnetic wave leakage may occur. Moreover, since the structure is not air-tight, the adhesion of liquid substances, etc., to this part may result in short-circuiting due to the entry of such substances into the interior parts. Also, there is a danger of invasion by dust, etc.

Furthermore, in the case of liquid crystal display devices that are illuminated by back lighting, a transparent light-conducting sheet is disposed on the back surface of the liquid crystal display device, light sources, e.g., fluorescent tubes, are disposed on both sides or on one side of this light-conducting sheet, and light from these light sources is transmitted through the light-conducting sheet and directed onto the liquid crystal display device. However, since light sources are disposed on both sides of the light-conducting sheet, the power consumption is increased compared to cases where a light source is disposed on only one side of the light-conducting sheet; furthermore, there is a danger that uniform illumination cannot be obtained over the entire surface of the liquid crystal display device.

[0005]

[Problems that the Device is to Solve]

The present device was devised in order to solve these problem points encountered in the prior art. The object of the present device is to provide a superior attachment structure for a liquid crystal display device [i] which, in the mounting of a liquid crystal display device and digitizer, makes it possible to accomplish the mounting of the liquid crystal display device with screw connections being omitted, [ii] which prevents complication of the construction by accomplishing electrical continuity without using lead wires, [iii] which facilitates replacement of the digitizer, [iv] which makes it possible to take shielding countermeasures in the pressure sensitive type tablet, and to prevent invasion by liquid substances and dust, etc., [v] which makes it possible to reduce the power consumption of the back lighting, and [vi] which makes it possible to achieve uniform illumination over the entire surface [of the liquid crystal display device].

[0006]



**[Means for Solving the Problems]**

In order to achieve such an object, the liquid crystal display device attachment structure of the present device is characterized by the fact that fastening parts are disposed on the outer peripheral parts of the panel of a liquid crystal display device, hooks are disposed on the inner peripheral parts of a case on which the above-mentioned panel is mounted, and holders consisting of plate springs whose end parts at one end cover the upper surfaces of the above-mentioned fastening parts, and whose other end parts are engaged with the [above-mentioned] hooks, are inserted between the above-mentioned fastening parts and hooks.

Furthermore, [the liquid crystal display device attachment structure of the present device] is characterized by the fact that the second end parts of the above-mentioned holders are engaged with the above-mentioned hooks, and [these holders] are constructed so that portions of the holders in the direction of width are extended to form terminal parts, and so that these terminal parts are pressed against the ground terminals of the printed board disposed on the above-mentioned case.

Furthermore, [the liquid crystal display device attachment structure of the present device] is characterized by the fact that the first end parts of the above-mentioned holders are substantially L-shaped bent parts.

Furthermore, [the liquid crystal display device attachment structure of the present device] is characterized by the fact that ground pattern parts are exposed around substantially the entire circumference on the outer circumferential part of the base plate of a pressure-sensitive type tablet disposed on the front surface of the panel of a liquid crystal display device, and packing consisting of a conductive rubber is clamped between the above-mentioned ground pattern parts and metal plating parts formed on the inside surface of a case.

Furthermore, [the liquid crystal display device attachment structure of the present device] is characterized by the fact that a transparent light-conducting sheet is clamped between a reflective sheet and the undersurface of the panel of the liquid crystal display device, a light source is disposed on one side part of the above-mentioned light-conducting sheet, plastic fibers are disposed along the undersurface of the above-mentioned light-conducting sheet, and a portion of the incident light from the light source is transmitted directly through the light-conducting sheet, and is directed onto the panel of the liquid crystal display device via the plastic fibers and light-conducting sheet.

**[0007]**

**[Operation]**

If such a construction is used, the liquid crystal display device can be securely mounted on the case using the elastic force of the holders; furthermore, the liquid crystal display device can be made freely detachable.

Since the holders are formed as ground terminals, [the liquid crystal display device] can be connected to the ground terminals on the printed board without using lead wires.

The liquid crystal display device and digitizer can be mechanically fastened in a secure manner by the substantially L-shaped bent parts of the holders, and these parts are freely detachable; accordingly, the use of an adhesive bonding system can be avoided.

**[0008]**

The leakage of electromagnetic waves, etc., can be effectively prevented by packing consisting of a conductive rubber that is clamped between the metal plating parts of the case and the ground pattern parts of the pressure sensitive type tablet that is disposed on the liquid crystal display device (in a pen input computer, etc.); furthermore, short-circuiting accidents caused by the invasion of liquid substances can be prevented, and invasion by dust, etc., can be prevented.

Furthermore, since a construction is used in which a portion of the incident light from the light source disposed on one side part of the liquid crystal display device is transmitted directly through the light-conducting sheet, while the remaining portion of this light is transmitted through plastic fibers and again caused to reach the inside of the light conducting sheet, the illumination can be made uniform over the entire surface of the liquid crystal display device, so that the display quality can be improved.

**[0009]**

**[Embodiments]**

Embodiments of the present device will be described below with reference to the figures.

Figure 1 is a perspective view which shows the overall construction constituting one embodiment of the present device. Figure 2 is a sectional view of essential parts along line A-A in Figure 1. Figure 3 is a sectional view of essential parts along line B-B in Figure 1. Figure 4 is a perspective view of essential parts illustrating another embodiment of the present device. Figure 5 is a sectional view of essential parts in Figure 4. Figure 6 is a perspective view illustrating another embodiment of the present device. Figure 7 is a partially sectional perspective view illustrating another embodiment of the present device. Figure 8 is a sectional

view of essential parts in Figure 7. Figure 9 is a sectional view of a back lighting part constituting another embodiment of the present device.

In Figures 1 through 3, fastening parts 14 consisting of short small pieces are disposed in (for example) four places on the outer peripheral part of the liquid crystal display device 10; furthermore, hooks 16 are disposed in four places on the inside peripheral part of the inside surface of a lower case 12 in which the liquid crystal display device 10 is mounted, and the liquid crystal display device 10 is fastened to the lower case 12 by means of the above-mentioned fastening parts 14 and hooks 16.

[0010]

The above-mentioned hooks 16 are disposed so that the respective fastening parts 14 are each enveloped by a hook member 16a oriented in the direction of length and hook members 16b, 16b oriented in the direction of width; [in these hooks 16,] a protruding part 16A is formed on the inside of the upper part of the hook member 16a.

Holders 18 are mounted between the above-mentioned fastening parts 14 and hooks 16. These holders 18 consist of plate springs or the like, and are molded and worked so that one end part [of each holder 18] is bent so as to cover the surfaces of the above-mentioned [corresponding fastening part 14], i.e., the upper surface and undersurface [of the corresponding] fastening part 14, and so that the other end part is bent in a U shape along the hook member 16a, and this end part is engaged with the protruding part 16A of the hook 16.

Thus, the liquid crystal display device 10 is securely mounted on the lower case 12 by the elastic force of the holders 18. Furthermore, when the liquid crystal display device 10 is to be detached from the lower case 12, this detachment can easily be accomplished by releasing the engagement with the hooks 16 by pressing the holders 18.

[0011]

In Figures 4 and 5, only the parts that differ from the embodiment shown in Figures 1 through 3 will be described.

20 indicates a printed board that is disposed on the lower case 12.

One end part of each holder 18' is bent so as to cover the surfaces of the above-mentioned [corresponding] fastening part 14, while the other end part is bent in a U shape so that a U-shaped part 18a is formed; this part is caused to run along the hook member 16a in contact with this hook member 16a, and the end part is engaged with the protruding part 16A of the hook 16.

Furthermore, the other end part is extended in the direction of width, and is further bent so that a terminal part 18b is formed; this terminal part 18b contacts the above-mentioned printed board 20, and is thus connected to ground.

[0012]

In Figure 6, only parts that are different from the embodiments shown in Figures 1 through 5 will be described.

22 indicates a digitizer that is disposed on the upper surface of the liquid crystal display device 10.

One end part of each holder 18" is bent so that this end part covers the surfaces of the above-mentioned [corresponding] fastening part 14, while the other end part is bent into a U shape and caused to run along the hook member 16a in contact with this hook member 16a; this end part is engaged with the protruding part 16A. Furthermore, the first end part is extended in the direction of height, and is further bent to form an L-shaped bent part 18c, thus forming a construction which makes it possible to mechanically fasten both the above-mentioned liquid crystal display device 10 and the digitizer 22 by means of the holders 18."

[0013]

Figures 7 and 8 are diagrams that show another embodiment of the present device.

11 indicates an upper case consisting of a plastic resin; here, a pressure sensitive type tablet 24 is disposed on the front surface of the liquid crystal display device 10 via a base plate 26, so that a pen input personal computer is constructed.

The base plate 26 is formed in the shape of a rectangular half surface [*sic*]<sup>†</sup>; ground pattern parts 28 are exposed with a specified width dimension around substantially the entire periphery on the outer peripheral edge part of the base plate 26. Recessed parts are formed in the inside surface of the upper case 11, and the surfaces of these recessed parts are formed as metal plating parts 30 that are plated with a metal. Packing 32 with a substantially rectangular cross-section shape that consists of a conductive rubber is clamped in an air-tight manner around the entire periphery between the metal plating parts 30 in the above-mentioned recessed parts and the ground pattern parts 28. Since the ground pattern parts 28 and metal plating parts 30 are thus electrically connected by the packing 32, the leakage of electromagnetic waves generated in the vicinity of the liquid crystal display device 10 is equally [*sic*] reduced.

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<sup>†</sup> Translator's note: apparent error in the original for "planar shape."

Furthermore, the above-mentioned packing 32 is formed with a seamless structure and has air-tight properties; accordingly, the entry of liquid substances and dust, etc., into the interior can be prevented, and short-circuiting accidents, etc., can be effectively prevented.

[0014]

In Figure 9, a transparent light-conducting sheet 38 consisting of (for example) a planar acrylic resin sheet, etc., is clamped between the undersurface of the liquid crystal display device 10 and the reflective sheet 34.

One side part of the light-conducting sheet 38 is formed as a perpendicular surface 38a. A light source 40 is disposed adjacent to this perpendicular surface 38[a], and the other side part [of the light-conducting sheet 38] is formed as an end surface 38b consisting of a bent surface that has an inclined surface; this end surface is maintained in tight contact with the bent reflective part 36 of the reflective sheet 34.

[0015]

A fluorescent tube, etc., is ideal for use as the light source 40.

A plurality of strips of plastic fibers 42 having a length that is substantially the same as the width of the light-conducting sheet 38 are disposed along the undersurface of the above-mentioned light-conducting sheet 38. A portion of the incident light from the light source 40 is transmitted directly through the light-conducting sheet 38 as indicated by the arrow A; this light is reflected by the reflective sheet 34 and is directed onto the liquid crystal display device 10. Meanwhile, the remaining portion of the above-mentioned incident light passes through the plastic fibers 42, and is reflected by the bent reflective part 36, so that this light again reaches the inside of the light-conducting sheet 38 from the above-mentioned end surface 38b. As is indicated by the arrow B, this light is reflected by the reflective sheet 34, and is directed onto the liquid crystal display device 10. Thus, all of the incident light from the light source 40 disposed on only one side part of the liquid crystal display device 10 is directed onto the liquid crystal display device 10, so that uniform illumination over the entire surface can be achieved, thus improving the display quality.

[0016]

As was described above, the liquid crystal display device attachment structure of the present device is characterized by the fact that fastening parts are disposed on the outer peripheral parts of the panel of a liquid crystal display device, hooks are disposed on the inner peripheral parts of a case on which the above-mentioned panel is mounted, and holders consisting of plate springs

whose end parts at one end cover the upper surfaces of the above-mentioned fastening parts, and whose other end parts are engaged with the [above-mentioned] hooks, are inserted between the above-mentioned fastening parts and hooks:

Furthermore, [the liquid crystal display device attachment structure of the present device] is characterized by the fact that the second end parts of the above-mentioned holders are engaged with the above-mentioned hooks, and [these holders] are constructed so that portions of the holders in the direction of width are extended to form terminal parts, and so that these terminal parts are pressed against the ground terminals of the printed board.

Furthermore, [the liquid crystal display device attachment structure of the present device] is characterized by the fact that the first end parts of the above-mentioned holders are substantially L-shaped bent parts.

Furthermore, [the liquid crystal display device attachment structure of the present device] is characterized by the fact that ground pattern parts are exposed around substantially the entire circumference on the outer circumferential part of the base plate of a pressure-sensitive type tablet disposed on the front surface of the panel of a liquid crystal display device, and packing consisting of a conductive rubber is clamped between the above-mentioned ground pattern parts and metal plating parts formed on the inside surface of a case.

Furthermore, [the liquid crystal display device attachment structure of the present device] is characterized by the fact that a transparent light-conducting sheet is clamped between a reflective sheet and the undersurface of the panel of the liquid crystal display device, a light source is disposed on one side part of the above-mentioned light-conducting sheet, plastic fibers are disposed along the undersurface of the above-mentioned light-conducting sheet, and a portion of the incident light from the light source is transmitted directly through the light-conducting sheet, and is directed onto the panel of the liquid crystal display device via the plastic fibers and light-conducting sheet.

[0017]

#### [Effect of the Device]

As was described above, the present device makes it possible to make the liquid crystal display device thinner, and allows easy mounting and detachment of the liquid crystal display device (with screw connections omitted) when a liquid crystal display device and digitizer are mounted.